PATENT SPECIFICATION 1,062,610

DRAWINGS ATTACHED.

Inventor:—CHARLES GRENVILLE PARSONS.

1,062,610

Date of filing Complete Specification: Feb. 11, 1966.

Application Date: Nov. 19, 1964. No. 47188/64.

Complete Specification Published: March 22, 1967.

Index at Acceptance:—F2 U(2A4A, 2A4C, 2E, 2J); B3 J15; B3 Q(2A8, 4); B3 U11.

Int. Cl.:—F 16 d //B 21 d, j.

COMPLETE SPECIFICATION.

Improvements relating to the Attachment of Components to Shafts.

We, STONE MANGANESE MARINE LIMITED, of Anchor and Hope Lane, London, S.E.7, a Company incorporated under the laws of Great Britain, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns improvements relating to the attachment of components to shafts, especially but not exclusively marine propellers to propeller shafts. Another especially useful application is the attachment of drive pulleys to shafts. A particular object of the invention is to achieve an effective and reliable interference fit for the purpose of attaining a high torque-carrying capacity without the use of mechanical attachment or locking means.

According to the invention, interference between a component with a tapered or parallel hole and a shaft of complementary shape is produced by swelling the shaft within the said hole with the assistance of means comprising a pin which has a slight taper, suitably between 1 in 30 and 1 in 70, and is fitted into an axial bore having a like taper and extending in the shaft for substantially the length of fit between the said hole and shaft, the pin being provided at its outer end with a fine thread, which is engaged in a complementary thread in the bore, and being also provided with passages which communicate with grooves at the circumferential surface of the pin and through which hydraulic medium at high pressure is admitted at the same time as the pin is screwed into the bore. As the pin is screwed in simultaneously with the supply of the said medium, the latter is sealed within the bore to swell the shaft within the hole in the component and give the required intereference. When this interference, which can readily be determined by measurement in known manner, has been achieved, the hydraulic pressure is relieved, leaving the component attached to the shaft with a predetermined interference fit. To remove the component from the shaft, hydraulic pressure is applied through the pin and the pin is screwed out. The component can then be withdrawn from the shaft. Both for attachment and removal, the use of the hydraulic pressure ensures that only a relatively small moment is required for turning the pin and a conventional fine thread can be employed.

One manner of carrying the invention into effect will now be more fully described by way of example and with reference to the accompanying drawing, which is a longitudinal section through part of a shaft 1 and a component 2 attached thereto. The component 2 might be the hub or boss of a marine propeller, in which case the shaft 1 would be the propeller shaft. The component 2 might alternatively be the hub of a belt or chain pulley and the shaft 1 a driving or driven transmission shaft. The hub 2 is mounted with a tapered hole 3 on a tapered end portion 4 of the shaft 1.

Inside the tapered portion 4, the shaft 1 has a tapered axial bore 5 which accommodates a pin 6 having the same taper. A good machine finish should be provided on the bore 5 and pin 6. As illustrated, the tapered bore 5 runs into a cylindrical bore 7 extending through the shaft 1, but it may have a closed, radiused, inner end. At its outer end, the pin 6 is provided with a fine thread 8 which is screwed into a complementary thread in a recess 9 at the outer end of the bore 5. For turning the pin 6,

its outer extremity is formed with a square portion 10 to which an ordinary spanner can be applied.

The pin 6 has an axial bore 11 communicating by way of radial bores 12 with annular grooves 13 of semi-circular cross section provided at intervals along the surface of the pin. The bore 11, which is closed at its inner end, communicates at its outer end with a threaded central socket 14 for receiving an oil-pipe union.

For the purpose of giving a typical numerical example, it may be assumed that the shaft 1 illustrated has a diameter of 6 inches. The pin 6 has a taper of 1 in 50. The thread 8 is a 2½ inch British Standards Fine Thread. The oil pressure to be supplied to the bore 11, which may be delivered by a plunger-type pump, may be 4,000 to 6,000 lbs. per square inch or more. The taper on the end part 4 of the shaft 1 will depend upon the particular requirements. In a typical case for a marine propeller, 1 in 20 will generally be suitable, but the taper may be less, say 1 in 30 or even as little as 1 in 80.

For mounting the component on the shaft 1, it is only necessary, as described above, to slide the hub 2 over the tapered end 4 of the shaft and then to admit oil under pressure through the bores 11, 12 to the grooves 13, thereby swelling the bore 5, while at the same time screwing in the pin 6 until a required interference condition, suitably interference of the order of 0.005 inch in this example, has been achieved, whereupon the pressure is relieved. No mechanical provision is required for locking the pin 6 in position, as a taper of the order of 1 in 50 is well in excess of the value necessary for the pin to be self-holding in the bore 5.

Three to five annular grooves 13 will normally be sufficient, but more than five grooves may be used, if desired. Instead of the annular grooves 13 shown, helical grooves may be provided. Indeed such grooves might form one continuous helical groove extending over approximately the length of pin between the inner and outer grooves 13 in the embodiment illustrated.

The above-described arrangement is very appropriate for the attachment of a propeller hub of bronze or like alloy to a steel shaft. It can, however, be applied to the attachment of other components and with other materials. It is not essential that the hole 3 and shaft portion 4 should be tapered.

WHAT WE CLAIM IS:—

1. A method for the attachment of a component to a shaft, wherein interference is produced between the component, which has a tapered or parallel hole, and a shaft portion of complementary shape by swelling the shaft within the hole with the assistance of a pin which has a slight taper and is fitted into a bore having a like taper and extending in the shaft for substantially the length of fit between the said hole and shaft, the pin being provided at its outer end with a fine thread, which is engaged in a complementary thread in the bore, and being also provided with passages which communicate with grooves at the circumferential surface of the pin and through which hydraulic medium at high pressure is admitted at the same time as the pin is screwed into the bore.

2. A method for the attachment of a component to a shaft which comprises inserting a pin having a slight taper into a bore which has a like taper and which extends in the shaft for substantially the length of fit between the component and shaft and producing an interference fit between the said shaft and component by admitting a hydraulic medium at high pressure through the pin to parts of the surface of the said bore while at the same time screwing the pin into the said bore.

3. A method according to claim 1 or 2, wherein the taper of the pin and bore is about 1 in 50.

4. A method according to claim 1, 2 or 3, wherein the hydraulic medium is admitted by way of a longitudinal passage, in the pin, which communicates with annular grooves provided at intervals along the circumferential surface of the pin.

5. A method for the attachment of a component to a shaft substantially as hereinbefore described with reference to the accompanying drawing.

6. A shaft having a component attached to it with an interference fit produced by the method claimed in any one of claims 1 to 5.

7. A shaft having means for the attachment of a component with an interference fit, wherein the shaft is formed with an axial bore having a slight taper and extending for the length over which the component is to be attached and with a fine screw thread at one end of the said bore, which bore accommodates a pin having a like taper and a threaded portion screwed into the said fine thread, the said pin having grooves in its circumferential surface and a longitudinal passage through which a hydraulic medium at high pressure can be supplied to the said grooves.

JENSEN & SON,
Agents for the Applicants,
77, Chancery Lane,
London, W.C.2,
Chartered Patent Agents.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1967.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

1062610 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*